The Fertilisation of Fumariaceæ

IT was with great pleasure and interest that I read the communications from Mr. Darwin and Dr. Hermann Müller in NATURE, vol. ix. p. 460.

It so happens that, since writing the note on the tardy and apparently useless assumption of colour by *Fumaria capreolata* var. *pallidiflora*, I have chanced to see the flowers of this plant visited, on two occasions, by a bee in the daytime.

This insect was, on both occasions, I believe, a mason-bee, and certainly neither a hive nor a humble bee, and, as it confined its attentions to this one variety of fumitory, and was engaged for some time at its work, I had a favourable opportunity of watching the mode of operation.

The bee ranged from plant to plant, but, in every case, would only alight on and suck those flowers which, though still white, had assumed the horizontal position, these flowers alone affording a comfortable landing-stage for the insect.

The bee then clasped the lower part of the tube with its feet, and prized open the flower by thrusting its sheathed proboscis underneath the upper petal, when the tube split lengthwise, and gaped widely open, the style and stamens rising up and emerging from the cap formed by the inner petals, much as they do from the keel in many papilionaceous flowers, and rubbing against the underside of the bee's body.

I may observe that it is precisely in the short period during which the flower maintains itself in the horizontal position that the emission of pollen takes place, and this coincidence of the plant bidding for the visits of insects at that particular moment has much the appearance of special adaptation.

But an examination of the flowers certainly shows that they are capable of self-fertilisation, and Dr. Hermann Müller tells us that Dr. Hildebrand states that this is habitually the case in *F. capreolata*.

I regret that I am only acquainted with Dr. Hildebrand's paper through a review which appeared in the *Bulletin* of the Société Botanique de France, where but few of the details are given.

I have not paid special attention to the structure and habits of the *Fumariaceæ*, and I am therefore unable to say whether the plant to which I have alluded is commonly visited by insects in the daytime, or whether, as Mr. Darwin suggests, its flowers, the nearly white colour of which would render them peculiarly conspicuous in the dusk, may not prove especially attractive to moths and other night-fliers.

While watching the bee whose operations are described above, I noted with interest that it confined its attention exclusively to plants of this single variety of fumitory, winding its way through flowering masses of other fumitories and weeds.

In the same way a honey-bee, at the same spot on a later day, exclusively visited the wild mignonette (*Reseda phyteuma*), passing by the fumitories, marigolds, &c.

J. TRAHERNE MOGGRIDGE

Maison Gastaldy, Mentone, April 20

ALLOW me shortly to resume the different views which have been proposed in your columns, as giving a possible explanation of the fact that the flowers of *F. pallidiflora* attain their brightest colouring when the time for fertilisation has passed, and to point out the observations indispensable to be made, in order to ascertain which of the proposed views is right. 1. It is possible that nocturnal Lepidoptera are the fertilisers of the fumitory; in this case it would be most probable that the pale colour of its flowers has been acquired by natural selection, pale flowers being most conspicuous in the dusk. 2. Diurnal insects may be the fertilisers, and the pale hue may be sufficiently conspicuous or even more attractive for them than the brighter one. In this case, also, the former must be considered as acquired by natural selection; the latter, on the contrary, as in the first case, merely as the result of chemical processes. 3. Under the same supposition of diurnal insects being the fertilisers, it is possible that the older flowers, by their brighter hue, serve to attract insects to the younger and paler ones; in this case the bright hue of the older flowers may be looked upon as acquired under the influence of natural selection, the pale colour of the younger flowers at the same time being useless. 4. It is possible that self-fertilisation is the rule with the flowers of this fumitory, and that cross-fertilisation by insects takes place only very exceptionally; in this case not only, as in No. 3, the paler colour, but also the brighter one would be nearly independent of the influence of natural selection. In order to decide definitely which of these views is right, it is indispensable to watch perseveringly the flower of this plant, and to ascertain what kind of fertilisation naturally takes place. In case diurnal insects should prove by direct observation to be the fertilisers, it would be possible to decide whether supposition 2 or 3 is correct, by removing from many specimens every older flower as soon as its colour begins to grow brighter, and by observing whether these specimens or those with older and brighter flowers are more frequently visited by insects.

It would be a great pleasure to me to make these observations, but I do not know whence seeds of *Fumaria pallidiflora* can be obtained. Perhaps some reader of this letter may be good enough to give me information on this point.

Lippstadt, April 28 HERMANN MÜLLER

MR. COMBER'S suggestion (vol. ix. p. 484) that the coloured flowers of *Fumaria* attract insects to the uncoloured ones is very ingenious. Supposing that they are cross-fertilised, the case of *Poinsettia* is very pertinent, and is enforced by that of *Dalechampia*, also euphorbiaceous, in which the bracts, a beautiful rose colour before fertilisation, gradually assume afterwards the same green hue as the foliage when the bright colour is no longer needed. The chemical changes that take place in the flower at and after the period of its complete expansion must necessarily be complex, as well as varied in different cases. Rapid oxidation is probably one very effective agent in producing them, but the results will necessarily depend on what is operated upon. *Hibiscus mutabilis* is white in the morning, deep red by night. Species of *Lantana*, like *Myosotis versicolor*, pass through a whole series of colours as they expand. On the other hand all the beautiful species of *Franciscea* rapidly lose the tints with which their flowers open, and become nearly white. The final stages in the life of all the parts of the flower which are not accessory to the formation of the fruit are more or less processes of decay, and there is no absolute law that these should always be accompanied by inconspicuous or displeasing tints. The white flowers of *Calanthe veratrifolia* blacken when they are bruised; on the other hand, according to Kingsley, the crimson flowers of *Couroupita guianensis* turn blue when torn, as the pulp of the fruit is also known to do on exposure to the air. In the same way some fungi exhibit when bruised striking tints which yet can be of no service to them. *Agaricus georginæ* changes from snow-white to blood-red wherever it is touched, and the white flesh of *Boletus cyanescens* when broken changes instantly to the "most beautiful azure blue."

In fact if a chemical change is set up—if it produces a change of tint at all—it must *sometimes* produce a pleasing one; that it should do so is not necessarily advantageous to the plant, though open to be taken advantage of by it.

W. T. THISELTON DYER

Fertilisation of Corydalis claviculata

WITH regard to the flowers of *Corydalis claviculata* (of the discovery of which species in this neighbourhood I have sent a note to the *Journal of Botany*), I think Mr. Bennett (vol. ix. p. 484) will find his suspicion that the styles may have been broken off in dissecting to be correct. This may easily be shown by floating off in water the petals, &c., of a withered flower, in which the process of fertilisation has been completed, when the style will be seen adhering to the ovary, though the gentlest touch will be sufficient to separate it. In the bud the anthers cover the stigma, but at the time of maturity the latter projects slightly, so that it would be first touched by the proboscis of an insect. I suspect that it is also slightly protogynous, though self-fertilisation may probably be of frequent occurrence. The manner in which the style is embraced by the stamens and petals protects it from too rough a shock from the struggles of insects in the narrow entrance to the flower. I have not, however, observed them to visit it.

W. E. HART

Kilderry, co. Donegal, April 28

Lakes with two Outfalls

SINCE writing my letter of April 24, with which I forwarded a copy of the new Inch Ordnance map of Arran, I have received other copies from Mr. Stanford, showing, as I presume, that the early copies of General Sir H. James's admirable work have been revised. For, besides the elaborate system of contour lines, which did not appear in the first copies, *two* outlets are given to Loch-na-Davie, instead of one only. So that, as to the "matter